IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Denton et al.	**Conf. No.:**	4064
Serial No.:	10/710,065	**Art Unit:**	2121
Filing Date:	06/16/2004	**Examiner:**	Norton, Jennifer L.
Title:	OPTIMIZED SCHEDULING BASED ON SENSITIVITY DATA	**Docket No.:**	BUR920040051US1 (IBMB-0044)

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Commissioner for Patents
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BRIEF OF APPELLANT

This is an appeal from the Final Rejection (Office Action) dated July 2, 2007, rejecting claims 1-35. The requisite fee set forth in 37 C.F.R. §1.17 (c) was submitted on October 2, 2007.

REAL PARTY IN INTEREST

International Business Machines Corporation is the real party in interest.

RELATED APPEALS AND INTERFERENCES

There is no related appeal or interference.

STATUS OF CLAIMS

As filed, this case included claims 1-35. Claims 1-35 remain pending, stand rejected, and form the basis of this appeal. No claim has been allowed. The rejections of claims 1-35 are being appealed.

STATUS OF AMENDMENTS

After-final amendments of claims were entered following the Final Rejection of July 2, 2007.

SUMMARY OF THE CLAIMED SUBJECT MATTER

Independent claim 1 provides a method comprising the steps of: a. providing a floor schedule of an assembly unit (60) for a device (¶¶ 0032, 0043); b. optimizing the floor schedule based on sensitivity data of the device during operation of the assembly unit (60) on the floor schedule (¶¶ 0033, 0044, and 0046); and operating the assembly unit (60) based on the optimized floor schedule (¶ 0047).

Independent claim 12 provides a computer program product (22) comprising a tangible computer useable medium (12) having computer readable program code embodied therein for optimizing a floor schedule of an assembly unit for a device, the program product comprising: program code configured to analyze sensitivity data for the device during operation of the assembly unit on the floor schedule (¶¶ 0033, 0046); and program code configured to optimize the floor schedule of the assembly unit based on the sensitivity data (¶ 0046).

Independent claim 19 provides an optimizer system (10) comprising: a model analyzer (28) for receiving sensitivity data for a device of an assembly unit (¶¶ 0044-45), and analyzing the sensitivity data during operation of the assembly unit on a floor schedule (¶ 0046); and a scheduling optimizer (30) for optimizing the floor schedule of the assembly unit based on the analyzed sensitivity data (¶ 0046).

Independent claim 26 provides a method comprising the steps of: generating sensitivity data for a device of an assembly unit during operation of the assembly unit on a floor schedule (¶ 0044); and receiving an optimal path data of the floor schedule that is generated based on the sensitivity data (¶ 0047, see also ¶ 0046), wherein the optimal path data controls the path of the device through the assembly unit (¶ 0047).

Independent claim 32 provides a testing unit (250) comprising: a sensitivity monitor (252) for generating sensitivity data for a device (¶ 0144, ¶ 0044); a reliability generator (264) for generating reliability data having rules for the device (¶ 0144); and a tool controller (254) for invoking the sensitivity monitor and reliability generator and shutting down a testing tool of the testing unit (¶¶ 0144-45).

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. Whether claims 1-2, 4, 7-10, 12-16, 18-21, 23-24, 26-27 and 29-31 are anticipated under 35 U.S.C. 102(e) by Chong et al. (USPN 6,842,661), hereinafter “Chong.”

2. Whether claims 32-35 are unpatentable under 35 U.S.C. 103(a) over Chong in view of Miller (USPN 6,535,783).

3. Whether claims 3 and 28 are unpatentable under 35 U.S.C. 103(a) over Chong in view of Kraz (US Pub. No. 2004/0082083).

4. Whether claims 11 and 22 are unpatentable under 35 U.S.C. 103(a) over Chong in view of Miller.

5. Whether claims 5 and 17 are unpatentable under 35 U.S.C. 103(a) over Chong in view of Conboy (USPN 6,711,450).

6. Whether claim 6 is unpatentable under 35 U.S.C. 103(a) over Chong in view of Conboy and further in view of Shirley (USPN 6,351,684).

7. Whether claim 25 is unpatentable under 35 U.S.C. 103(a) over Chong in view of Miller and further in view of Conboy.

ARGUMENTS

1. Claims 1-2, 4, 7-10, 12-16, 18-21, 23-24, 26-27 and 29-31 are not anticipated under 35 U.S.C. 102(e) by Chong.

With respect to independent claims 1, 12, 19 and 26, Chong does not disclose, *inter alia*, "optimizing the floor schedule based on sensitivity data of the device[.]" (Claim 1, similarly claimed in claims 12, 19 and 26). Chong only discloses detecting electrical characteristics and/or metrology data of interconnects, e.g., "data relating to the electrical characteristics of various interconnect locations" (col. 5, lines 11-13), "interconnect characteristics" (col. 5, line 60), barrier layer position and characteristics of a contact formed in a trench and characteristics of the trench 540 (*see*, col. 6, lines 20-26), and "physical or electrical characteristics of the devices formed across the semiconductor wafer 105" (col. 8, lines 51-52). Chong does not disclose detecting <u>sensitivity data</u> of interconnects. Note that sensitivity refers to a degree of change in one thing in response to a unit amount of change in another thing. (*See*, e.g., *The American Heritage® Dictionary of the English Language, Fourth Edition*, sensitivity is "the degree of response of a receiver or instrument to an incoming signal or to a change in the incoming signal", recited in www.dictionary.com). The electrical characteristics and/or metrology data in Chong does not include such sensitivity data. As such, Chong does not collect sensitivity data of a device and thus does not disclose optimizing a floor schedule based on sensitivity data of the device.

In the Office Action, the Examiner wrongfully enlarges the scope of "electrical characteristics" as including "sensitivity data". The Examiner lists disclosures of Chong to assert that Chong discloses "data involving risk factors of the device" (examples of sensitivity data provided in the current application). (Office Action at pages 20-21). Specifically, the Examiner asserts that the disclosed "electrical characteristics" in Chong are equivalent to "data involving risk factors of the device" in the claimed invention.

Appellants respectfully disagree because data involving a risk factor of the device refers to a change in a variable (of the device) in response to a change in another variable (e.g., an ESD in the processing of the device), i.e., the exposure to a risk factor. Note that data involving a risk factor is evaluated by comparing the risk of those exposed to the potential risk factor to those not exposed to the risk factor. (http://en.wikipedia.gov/Risk_Factor). To this extent, the cited portions of Chong, and the disclosure of Chong as a whole, do not include data involving risk factors of the device. For example, the "predetermined resistivity value for particular interconnect locations", the "physical or electrical characteristics", or "interconnect characteristics" in Chong are not data involving risk factors because they do not refer to a change in a variable in response to the exposure to a risk factor. In view of the foregoing, Appellants respectfully submit that the rejection is defective because the Examiner wrongfully construes "electrical characteristics" of Chong as including the claimed "sensitivity data". Accordingly, Appellants respectfully request reversal of the final rejection.

In addition, the disclosure of Chong does not enable an implementation of the claimed invention. Chong only provides resistivity of a contact or a via in describing the "electrical characteristics" of an interconnect and only provides changing the physical dimensions of the interconnect based on the resistivity. Such a disclosure does not enable an implementation of "optimizing the floor schedule based on sensitivity data of the device" (claim 1) because the disclosed resistivity detecting and controlling does not enable a person of skill to instead implement optimizing a floor plan based on <u>sensitivity data of the device</u> without undue experiments.

In view of the above, Appellants submit that Chong does not anticipate the claimed invention and the final rejection should be reversed.

2. Claims 32-35 are not obvious under 35 U.S.C. 103(a) over Chong in view of Miller.

With respect to independent claim 32, Appellants submit that the arguments regarding claims 1, 12, 19 and 26 also apply because Chong does not disclose or suggest, *inter alia*, "generating sensitivity data for a device[.]" (Claim 32). Appellants submit that Miller does not overcome, *inter alia*, this deficiency of Chong. In view of the foregoing, the suggested combination of Chong and Miller does not make the claimed invention obvious and the final rejection should be reversed.

3. Claims 3 and 28 are not obvious under 35 U.S.C. 103(a) over Chong in view of Kraz.

With respect to claims 3 and 28, the Examiner admits that Chong does not teach the claimed features but relies on Kraz to overcome the deficiencies of Chong. (*See* Office Action at pages 10-12.) Specifically, the Examiner asserts that Kraz discloses monitoring ESD of a process tool. Appellants disagree because Chong also does not teach "the sensitivity data includes at least one of electrostatic discharge sensitivity data ...." (Claim 3 of the claimed invention, emphasis added, similarly in claim 28). Kraz discloses monitoring an ESD occurrence in a semiconductor process tool. (*See*, e.g., paragraph 0009.) Kraz monitors the ESD occurrences inside a semiconductor manufacturing tool (*see* paragraph 0034) regarding the source, strength and frequency

of the ESDs (*see* paragraph 0025), but <u>does not monitor electrostatic discharge sensitivity data</u> of the processed devices. In addition, the claimed invention includes ESD sensitivity data <u>of the device manufactured</u>, not the ESD occurrence inside the process tool as disclosed in Kraz.

The Examiner argued that Kraz discloses that the monitored ESD occurrences can be used for failure analysis (Office Action at page 11, citing Kraz at paragraph 0028), however, the peripheral mentioning of failure analysis is not equivalent to optimizing the floor schedule based on, e.g., the ESD sensitivity data, because Kraz does not disclose obtaining ESD sensitivity data.

In view of the foregoing, Chong and Kraz, even in the suggested combination, do not disclose or suggest all claimed features of claim 3 or claim 28. Accordingly, the final rejection is defective and should be reversed.

4. Whether claims 11 and 22 are not obvious under 35 U.S.C. 103(a) over Chong in view of Miller.

Claims 11 and 22 are believed allowable based on their allowable base claims, respectively, as well as for their own additional features.

5. Whether claims 5 and 17 are unpatentable under 35 U.S.C. 103(a) over Chong in view of Conboy (USPN 6,711,450).

Claims 5 and 7 are believed allowable based on their allowable base claims, respectively, as well as for their own additional features.

6. Whether claim 6 is unpatentable under 35 U.S.C. 103(a) over Chong in view of Conboy and further in view of Shirley (USPN 6,351,684).

Claim 6 is believed allowable based on its allowable base claims, as well as for its own additional features.

7. Whether claim 25 is unpatentable under 35 U.S.C. 103(a) over Chong in view of Miller and further in view of Conboy.

Claim 25 is believed allowable based on its allowable base claims, as well as for its own additional features.

In view of the foregoing, Appellants submit that the final rejection is defective, and should be reversed.

Respectfully submitted,

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Dated: December 7, 2007

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CLAIMS APPENDIX

1. A method comprising the steps of:

a. providing a floor schedule of an assembly unit for a device;

b. optimizing the floor schedule based on sensitivity data of the device during operation of the assembly unit on the floor schedule; and

operating the assembly unit based on the optimized floor schedule.

2. The method of claim 1, further comprising the steps of receiving the sensitivity data and optimizing the floor schedule in real-time.

3. The method of claim 1, wherein the sensitivity data includes at least one of electrostatic discharge sensitivity data, electrical overstress sensitivity data, latch-up data, hot electron data, mobile ion contamination data, and negative bias threshold instability data.

4. The method of claim 1, further comprising the steps of generating sensitivity data for the device of an assembly unit during operation of the assembly unit on a floor schedule; and receiving an optimal path data of the floor schedule based on the sensitivity data, wherein the optimal path data controls the path of the device through the assembly unit.

5. The method of claim 1, wherein step b) further comprises a step of prioritizing a testing of the device for sensitivities.

6. The method of claim 5, wherein the prioritizing step includes prioritizing the testing of a mask based on a size of a space on the mask.

7. The method of claim 1, wherein step b) further comprise a step of analyzing the sensitivity data of the device to estimate an amount of sensitivity of the device.

8. The method of claim 1, wherein step b) further comprises a step of analyzing the sensitivity data through at least one sensitivity model to estimate an amount of sensitivity of the device.

9. The method of claim 8, wherein the sensitivity model includes at least one of a human body model, a machine model, a charged device model, a transmission line pulse model, and a very fast transmission line pulse model.

10. The method of claim 8, further comprising a step of estimating a result of the at least one sensitivity model with a second sensitivity model in the case that data of the at least one sensitivity model is incomplete.

11. The method of claim 1, wherein step b) further comprises a steps of inhibiting a failed tool of the assembly unit based on the sensitivity data; and optimizing the floor schedule to avoid the failed tool.

12. A computer program product comprising a tangible computer useable medium having computer readable program code embodied therein for optimizing a floor schedule of an assembly unit for a device, the program product comprising:

program code configured to analyze sensitivity data for the device during operation of the assembly unit on the floor schedule; and

program code configured to optimize the floor schedule of the assembly unit based on the sensitivity data.

13. The program product of claim 12, further comprising program code configured to generate the sensitivity data for the device being assembled by the assembly unit.

14. The program product of claim 12, wherein the analyzing program code analyzes the sensitivity data through at least one sensitivity model to estimate an amount of sensitivity of the device.

15. The program product of claim 14, wherein the sensitivity model includes at least one of a human body model, a machine model, a charged device model, a transmission line pulse model, and a very fast transmission line pulse model.

16. The program product of claim 15, wherein the analyzing program code further estimates a result of the at least one sensitivity model with a second sensitivity model in response to that data of the at least one sensitivity model is incomplete.

17. The program product of claim 12, wherein the optimizing program code prioritizes a testing of the device for sensitivities.

18. The program product of claim 12, wherein the sensitivity data is received through a messaging system from at least one of the assembly unit and a testing unit.

19. An optimizer system comprising:

a model analyzer for receiving sensitivity data for a device of an assembly unit, and analyzing the sensitivity data during operation of the assembly unit on a floor schedule; and

a scheduling optimizer for optimizing the floor schedule of the assembly unit based on the analyzed sensitivity data.

20. optimizer system of claim 19, further comprising a testing unit for generating sensitivity data for the device.

21. The optimizer system of claim 20, wherein the sensitivity data is received through a messaging system from at least one of the assembly unit and the testing unit.

22. The optimizer system of claim 21, wherein the testing unit further comprises a sensitivity monitor for generating sensitivity data; a reliability generator for generating reliability data having rules for the device and assembly unit; and a tool controller for invoking the sensitivity monitor and reliability generator and shutting down a testing tool of the testing unit.

23. The optimizer system of claim 21, wherein the sensitivity data is generated through at least one sensitivity model.

24. The optimizer system of claim 23, wherein the sensitivity model includes at least one of a human body model, a machine model, a charged device model, a transmission line pulse model, and a very fast transmission line pulse model.

25. The optimizer system of claim 22, wherein the scheduling optimizer further comprises: an automated material handling system dispatcher for optimizing the floor schedule in real-time based on the sensitivity data and the reliability data; and a maintenance scheduler for scheduling maintenance based on the sensitivity data and the reliability data.

26. A method comprising the steps of:

generating sensitivity data for a device of an assembly unit during operation of the assembly unit on a floor schedule; and

receiving an optimal path data of the floor schedule that is generated based on the sensitivity data,

wherein the optimal path data controls the path of the device through the assembly unit.

27. The method of claim 26, further comprising the steps of generating the sensitivity data and receiving the optimal path data in real-time.

28. The method of claim 26, wherein the sensitivity data includes at least one of electrostatic discharge sensitivity data, electrical overstress sensitivity data, latch-up data, hot electron data, mobile ion contamination data, and negative bias threshold instability data.

29. The method of claim 26, wherein the sensitivity data is transmitted through a messaging system.

30. The method of claim 26, wherein the generating step further comprises the step of generating at least one sensitivity model with the sensitivity data.

31. The method of claim 30, wherein the sensitivity model includes at least one of a human body model, a machine model, a charged device model, a transmission line pulse model, and a very fast transmission line pulse model.

32. A testing unit comprising:

a sensitivity monitor for generating sensitivity data for a device;

a reliability generator for generating reliability data having rules for the device; and

a tool controller for invoking the sensitivity monitor and reliability generator and shutting down a testing tool of the testing unit.

33. The testing unit of claim 32, further comprising a messaging system for transmitting the sensitivity data and reliability data in real-time.

34. The testing unit of claim 32, wherein at least one sensitivity model is generated with the sensitivity data.

35. The testing unit of claim 34, wherein the sensitivity model includes at least one of a human body model, a machine model, a charged device model, a transmission line pulse model, and a very fast transmission line pulse model.

EVIDENCE APPENDIX

There is no evidence submitted.

RELATED PROCEEDINGS APPENDIX

There is no related proceeding.

CERTIFICATE OF SERVICES

There is no other party to this appeal proceeding.